An investigation of the longitudinal proximity effect in superconducting and normal metal TES

Ari-David Brown, James A. Chervenak, Nikhil S. Jethava, Gunther Kletetschka, Vilem Mikula

As the TES volume and (effective) Tc become very small – for volume < 10 μm x 10 μm x 0.5 μm and Tc < 90 mK – we approach a regime in which the noise equivalent power is dominated by fluctuations in power dissipating from the TES electrons to its phonons. Our ultimate goal is to build a TES bolometer that operates in this regime to be used for far-infrared and sub-mm astronomy. In this study, we characterize the $R$ vs $T$ behavior of small TES in order to engineer a TES bolometer that has a very low Tc. Sadleir et al [1] found that as the distance $L$ between two superconducting leads, with the lead Tc >> the TES Tc, connected at opposite ends of TES approaches zero, superconductivity is induced parallel to the current flow, or longitudinally, and results in a much higher effective TES Tc. Here we present effective Tc measurements of Mo/Au TES bounded by Nb leads as a function of $L$ which ranges between 4 and 36 μm. We observe that the effective Tc is suppressed for current density of order $10^{-6}$ A/μm². We also explore the possibility of using a normal metal TES.